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Description

Increasing the efficiency of hydrogen powered combustion engines.

The invention relates to a process for introducing a medium that is combustible in a combustion engine, especially a cryogenic medium such as hydrogen, into a combustion engine.

Similar processes for introducing a medium, especially a cryogenic medium, into a combustion engine, exclusively used hydrogen. The modified combustion engines usually used a hydrogen-suction-tube injection system, wherein said system essentially corresponded to the conventional suction-tube-injection systems used in conventional combustion-engines.

Because of the poor efficiency of combustion engines of this type using hydrogen-suction-tube-injection, the use of common rail high pressure injection systems is currently being tested.

Although common rail high pressure injection systems do not significantly improve the efficiency of a combustion engine, their use can increase displacement.

The disadvantage of the combustion engines with hydrogen suction tube injection currently used is that the gaseous hydrogen in the suction tube displaces a considerable

portion of the intake air thereby reducing the available volume of oxygen required for combustion. As a result, the displacement of a hydrogen-powered combustion engine with a suction tube injection is significantly lower than that of a gasoline or diesel-powered engine.

In the high-pressure injection of gaseous hydrogen in a closed cylinder – that when a valve or valves are closed, this disadvantage is overcome. To reduce the energy required for compression, the gaseous hydrogen is injected into the closed cylinder preferably just prior to top dead center of the piston.

The temperature of the intake air at top dead center is approximately 275°C. If cold oxygen is injected into the combustion chamber of the cylinder at this point, the compression temperature is decreased, thereby canceling out the energy required for compression.

The object of the invention is a similar process for introducing a medium, particularly a cryogenic medium, into a combustion engine that is free of the disadvantages described above.

The invention teaches that this problem can be solved by a similar process that is characterized by the fact that, prior to being introduced into the combustion engine, the medium is warmed up to at least the surrounding temperature, preferably at least 500° C

and introduced into the combustion engine at a pressure between 100 and 500 bar, preferably between 200 and 300 bar.

The high temperature to which the medium introduced into the combustion engine is heated is determined by whether the air/fuel mixture in the combustion chamber of the cylinder is ignited by outside energy or is self-igniting.

In principle the temperature to which the medium introduced into the combustion chamber is heated, cannot be high enough. The upper temperature threshold is determined in each case by the type of medium as well as the energy used for heating the medium.

The necessary injection pressure of between 100 and 500 bar can be efficiently built up, particularly when liquid hydrogen is used as fuel, in the hydrogen storage container while the medium is still in the fluid phase.

In an advantageous configuration of the inventive process for introducing a medium into a combustion engine, the medium is heated before being introduced into the combustion chamber at least partly through heat exchange with the single or one of the exhaust gas streams in the combustion engine.

In the configuration of the inventive process described above, alternative or supplemental processes can be considered, such as, for example, electrical heating, heating through

ombustion of a portion of the medium, etc. These alternative or supplemental processes are advantageously used primarily during the starting phase of the combustion engine.

The inventive process for introducing a medium into a combustion chamber allows the efficiency of a combustion engine to be increased up to approximately 50%. Each increase in efficiency, however, is a function of the selected compression ratio as well as the selected injection pressure.

The concept described above is for use with all mediums used as fuel, which do not fail or crack at the temperatures realized. When these fuels are used, the pressure is increased in the fluid phase and afterwards dampened in front of the injection nozzle.

If gaseous fuels, such as natural gas of GH_2, are used, only a portion of the energy can be yielded, since the fuel must be compressed. However, this is aided by the fuel tank pressure in the storage container.